United States
Department of
Agriculture

Forest Service

Forest
Products
Laboratory

DIVIDENDS FROM WOOD RESEARCH

Recent Publications

January — June 1984

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"Dividends From Wood Research" is a semiannual listing of recent publications resulting from wood utilization research at the Forest Products Laboratory (FPL). These publications are produced to encourage and facilitate application of Forest Service research. This issue lists publications received from the printer by the FPL Publications Section between January 1, 1984 and June 30, 1984.

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List of Categories

Publications are listed in this brochure within the following general categories:

adhesives

Adhesive Bonding of Wood and Other Structural Materials

Blomquist, R. F.; Christiansen, A. W.; Gillespie, R. H.; Myers, G. E.
1981 August; Madison, WI. Clark C. Heritage Memorial Series on Wood, Vol. 3. University Park, PA: Materials Research Laboratory, Pennsylvania State University; [1984]. 436 p. (Complete book available from EMMSE Project, 110 Materials Research Laboratory, Pennsylvania State University, University Park, PA 16802. Make check ($16 per copy) out to Pennsylvania State University.)

1. Bonded Wood Products—A Review

Gillespie, Robert H.
J. Adhesion 15:51-58; 1982.

The bonding of wood uses a significant amount of the adhesives consumed annually in the United States to manufacture a wide variety of consumer products. The role adhesives play in this conversion of a basic raw material into useful products is reviewed with a consideration for the ever-changing nature of the raw material, for an increasing population, and for the need to apply multiple-use management of our Nation's timber resources.

2. How Mole Ratio of UF Resin Affects Formaldehyde Emission and Other Properties: A Literature Critique

Myers, George E.
Forest Prod. J. 34(5):35-41; 1984.

A critical review was made of the literature concerned with how the formaldehyde to urea mole ratio (F/U) affects formaldehyde emission from particleboard and plywood bonded with urea-formaldehyde (UF) adhesives, and how this ratio affects certain other adhesive and board properties.

3. A Comparison of Accelerated and Real-Time Service Life Estimates of Four Elastomer-Based Mastic Construction Adhesives

River, Bryan H.
In: Supplier Side Technology & An Overview of the Durability of Adhesives and Sealants: Papers Presented at the 1982 Fall Seminar & Technical Mini-Seminar; 1982 October 17-20; Chicago, IL. Arlington, VA: The Adhesive & Sealant Council; 1982: 204-218.

This study determines if the rate process method of accelerated aging was useful for evaluating the long-term performance of mastic construction adhesives and generates information about the long term performance of selected adhesive types.

Based on both accelerated aging results and real-time exposures of adhesives in this study, well-formulated polyurethane, neoprene-phenolic, and styrene-butadiene type construction adhesives will perform satisfactorily over the lifetime of most wood structures.

4. Accelerated, Real-Time Aging for 4 Construction Adhesives

River, Bryan H.
Adhesives Age, February 1984:16-21.

Estimates of the time required for joints of four elastomer-based mastic-type construction adhesives to lose half of their original strength were made from rate-process analysis of accelerated aging data. The estimates were compared to actual performance of the adhesives over an 11-year period in three service conditions. Good support for the accuracy of the accelerated aging estimates was shown by real-time aging for three of the four adhesives in wet exposures. Aging in a 30% RH environment at 27°C showed very little degradation, but this in itself supported the long-life estimates obtained from dry accelerated aging.

Experience with a number of construction adhesives exposed to accelerated aging conditions in the laboratory and out of doors has revealed a broad spectrum of performance.

anatomy and properties

Effect of Mechanical Stress on the Dielectric Properties of Wood

James, William L.
Unnumbered publication. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1984. (Available from U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. Cost: $4.50 microfiche; $7.00 hard copy. Please give accession number when ordering: ADA 140 608.)

5. Tissue Proportions and Cell Dimensions For Red and White Oak Groups

Maeglin, R. R.; Quirk, J. T.
Can. J. Forest Res. 14: 101-106; 1984.

A vast source of oak wood is available for use in the United States for paper-making. Knowledge of the proportions of tissue types and cell dimensions for hardwoods, especially on a weight basis, could help extend their use in the pulp and paper industry. This report provides such information for 11 red and white oak species. A method for calculating tissue proportions by weight from proportions by volume is given. Results show the relationship of tissue proportions to both growth rate and site.

6. Cell-Wall Density of Douglas-Fir By Two Optometric Methods

Quirk, J. T.
Wood and Fiber Sci. 16(2): 224-236; 1984.

This paper compares two nondestructive procedures for estimating cell-wall density of Douglas-fir in both the green and oven-dry condition: the Dual-Linear measuring micrometer and the dot-grid eyepiece. Estimates from these procedures allow the cell-wall void volume and the spacing between microfibrils within the wall to be derived in both the green and oven-dry conditions. These estimates also provide a basis to approximate dry wall density and void volume, both important in chemical bulking treatments, chemical modification, permeability studies, shrinkage, growth responses to silvicultural treatments, and heritability studies.

7. Nonvestured Pits in Koompassia Maingay (Leguminosae)

Quirk, J. T.; Miller, R. B.
IAWA Bull. n.s., 4(4): 191-195; 1983.

The study reported here indicates that vestured pits are absent in *Koompassia*. We at the Forest Products Laboratory have had some difficulty identifying material as *Koompassia*. Specimens resembling legumes but having no vestured pits could not be identified as *Koompassia* until possible identifications without vestured pits had been eliminated. Quirk, in his study on commercial legumes of tropical Asia and Australia, confirmed that *Koompassia* lacked vestured pits. To further substantiate the above observations, the authors have examined the vessel pits of *Koompassia* with the scanning electron microscope (SEM). The results of this examination are reported in this paper.

buildings and construction

8. Forest Products for Building Construction

McNatt, J. Dobbin; Galligan, William L.; Hans, Gunard E.
Wood and Fiber Sci. 16(2): 180-213; 1984.

Wood buildings may be of light frame-type as in residential and light industrial construction or heavy timber-type as in warehouses and other industrial/commercial buildings. In either case, the primary elements making up the structure are framing members; covering materials for roofs, walls, and floors; and connections within and between framing members and covering materials. Framing members include 2-inch dimension lumber, solid timbers, glulam beams, and various built-up beams and trusses. Design properties and specifying procedures for these various wood building materials and their connectors are discussed in some detail in this paper, and sources for further information are referenced.

9. Probability Distributions For Wood Walls in Bending

Polensek, Anton; Gromala, David S.
J. Struct. Eng. ASCE 110(3): 619-636; 1984

Strength and stiffness distributions of wood-stud walls were simulated on a computer using experimentally determined properties of framing, sheathing, and joints. The main objective of this study was to generate performance distributions of wood-stud walls built with currently produced Douglas-fir and southern pine studs of *Stud* grade. An additional objective was to develop the basis for a general probabilistic design methodology for wood-stud walls acting in bending.

10. The Cost of Wood vs. Masonry

Spelter, H. N.; Gjovik, Lee R.
New England Builder 2(9): 20-21; 1984.

A relatively new development in foundations is the preservative-treated wood foundation. This paper presents the relative costs of the wood foundation system versus the costs of a masonry foundation.

Controlling Moisture in Houses

TenWolde, Anton; Suleski, Jane Charlton
Solar Age 34-37; 1984. (Available from Solar Age Reprint Service, Church Hill, Harrisville, NH 03450)

High indoor humidity levels can lead to serious moisture problems during the winter in cold regions. These problems range from mildew in wall corners and closets to condensation on windows to decay inside the wall or on the underside of the roof sheathing. On the other hand, moderate levels of indoor humidity are important for human health and comfort. With an understanding of the basic principles of moisture balance, you can design and manage for proper moisture levels as explained in this paper.

11. Predicting the Strength of Wood-Joist Floors

Wheat, Dan L.; Moody, Russell C.
USDA Forest Serv. Res. Pap. FPL 445. 1984.

Most structural analyses of wood-joist floors have been based on the assumption of linear response. Although linear models, such as the FEAFLO computer program, adequately predict stiffness at service loads, they do not adequately predict failure loads because they do not include the nonlinear behavior of the nailed joints. Models based on nonlinear behavior are available, but they are more complicated and costly to use than linear analyses. This study used the nonlinear model NONFLO and the linear model FEAFLO to explore relationships between results of linear and nonlinear analyses. This information will enable researchers and organizations which wish to assess the structural reliability of wood floor systems to use less expensive linear analysis techniques to account for the nonlinear behavior of wood-joist floors.

12. Longtime Performance of Trussed Rafters with Different Connection Systems

Wilkinson, Thomas Lee
USDA Forest Serv. Res. Pap. FPL 444. 1984

Trussed rafters with seven different connecting systems were observed under load for periods of 5, 10, and 15 years. After each 5-year period, trusses were unloaded and evaluated for strength and stiffness under laboratory conditions. This paper contains the results from all three periods. At the end of 15 years, total deflection of the trusses under constant load increased about two to three times the initial deflection. Total deflection was still at an acceptable level.

Strength of Southern Pine 2 x 4 Beam-Columns

Zahn, John J.
Unnumbered publication, Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory; 1984. (Available from U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. Cost: $4.00 microfiche; $10.00 hard copy. Please give accession number when ordering: ADA 143 138.)

chemistry

13. Kinetic Modeling of Hardwood Prehydrolysis. Part I. Xylan Removal by Water Prehydrolysis

Conner, Anthony H.
Wood and Fiber Sci. 16(2): 268-277; 1984

The kinetics of xylan removal from quaking aspen, paper birch, American elm, and red maple by water prehydrolysis (autohydrolysis) was reevaluated, and additional data for the water prehydrolysis of southern red oak were obtained. This paper presents an improved method for modeling xylan removal that allows modeling throughout the course of its reactions.

14. Tall Oil Precursors in Sweetgum

Foster, Daniel O.; Zinkel, Duane F.
Wood and Fiber Sci. 16(2): 298-301; 1984.

Sweetgum is the major hardwood species being used by the kraft pulp industry of the southeastern United States. An accurate description of the diethyl ether extract is necessary to determine the quantity and quality of tall oil obtainable from this wood. The objective of this work was to define the amount and composition of tall oil precursors in fresh sweetgum wood.

15. Minor Components of Ponderosa Pine Oleoresin

Fujii, Ryoichi; Zinkel, Duane F.
Phytochemistry 23(4): 875-878; 1984.

Esters of ferulic acid with monoterpene alcohols were found in ponderosa pine oleoresin. These colorless ferulic acid esters are responsible for a yellow band seen on DEAE-Sephadex fractionation of the oleoresin. Two diterpene resin acids not previously found in pines and several resin acid artifacts were identified.

16. Mutants of *Pachysolen tannophilus* Showing Enhanced Rates of Growth and Ethanol Formation form D-xylose

Jeffries, Thomas W.
Enzyme Microb. Technol. 6:254-258; June 1984.

This research sought mutants of *P. tannophilus* having improved rates of xylose fermentation. Since satisfactory assay methods for the quantitation of ethanol production on plates were not known, it was necessary to develop enrichment methods and indirect screening techniques that would allow the selection of better fermenters.

Degradation of Lignin

Kirk, T. Kent
In: Gibson, David T., ed. Microbial degradation of organic compounds. Microbiology Series, Vol. 13, New York: Marcel Dekker, Inc.; 1984: Chapter 14. (Complete book is available from Marcel Dekker, Inc., 270 Madison Ave., New York, NY 10016.)

This chapter presents an overview of the process of lignin biodegradation. An attempt has been made to provide a coordinated interpretation based on the current understanding, which is rapidly improving but still quite incomplete. Emphasis is placed on the chemistry, biochemistry, and physiology of lignin degradation by higher fungi.

17. Biochemistry of Lignin Degradation by *Phanerochaete chrysosporium*: Investigations with Non-Phenolic Model Compounds

Kirk, T. Kent; Tien, Ming
In: Higuchi, T.; Chang, Hou-min.; Kirk, T. Kent, eds. Recent advances in lignin biodegradation: Proceedings of an international seminar, organized under the auspices of the U.S.-Japan cooperative science program; 1983 May 31-June 2; Kyoto, Japan. Tokyo, Japan: Uni Publishers Co., Ltd.; 1983: 233-245.

Intact ligninolytic cultures of *Phanerochaete chrysosporium* degrade nonphenolic β-1 model compounds via an initial oxidative cleavage between C_α and C_β. The objective of the present investigation was to identify the biochemical agent responsible for that cleavage. We examined the hypothesis that activated oxygen species produced by the cultures affect the cleavage, and we also attempted to reconstitute the actual cleavage system from culture components.

18. Lignin-Degrading Enzyme from *Phanerochaete chrysosporium*: Purification, Characterization, and Catalytic Properties of a Unique H_2O_2-Requiring Oxygenase

Tien, Ming; Kirk, T. Kent
Proc. Natl. Acad. Sci. USA 81:2280-2284; 1984.

An extracellular lignin-degrading enzyme from the basidiomycete *Phanerochaete chrysosporium* Burdsall was purified to homogeneity by ion-exchange chromatography. This ligninase is extracellular and requires H_2O_2 for activity. This paper describes its purification and characterization.

19. Analytical Pyrolysis of Hardwood and Softwood Lignins and Its Use In Lignin-Type Determination of Hardwood Vessel Elements

Obst, John R.
J. Wood Chem. and Technol. 3(4): 377-397; 1983.

Pyrolysis-gas chromatography-mass spectrometry was performed on milled wood lignins (MWLs) and wood samples. Among the major pyrolysis products identified from loblolly pine lignin were guaiacol, 4-methylguaiacol, 4-vinylguaiacol, vanillin, coniferaldehyde, and coniferyl alcohol. Presented here are the initial findings, notably on hardwood vessel lignin, from a study of the analytical pyrolysis of lignins of loblolly pine, white oak, white birch, and American elm.

20. Characterization of Hardwood Lignin: Investigation of Syringyl/Guaiacyl Composition by ^{13}C Nuclear Magnetic Resonance Spectroscopy

Obst, John R.; Ralph, John
Holzforschung 37(6): 297-302; 1983.

Carbon-13 nuclear magnetic resonance spectroscopy was investigated as a method to determine the relative syringyl/guaiacyl composition of hardwood lignins. By this technique, red oak fiber and middle lamella milled wood lignins (MWLs) were similar while white birch MWLs from different morphological regions gave apparent differences in their syringyl/guaiacyl ratios. Molecular weight distributions of the MWLs suggested that birch middle lamella lignin was higher in molecular weight than fiber cell wall lignin.

The Chemical Composition of Wood

Pettersen, Roger C.
In: Rowell, Roger M., ed. The chemistry of solid wood. Advances in chemistry series 207. Washington, DC: American Chemical Society; 1984: Chapter 2. (Complete book is available from American Chemical Society, 1155 Sixteenth Street NW., Washington, DC 20036. Cost: $49.95 for members; $79.95 for nonmembers; and $95.95 for foreign mailing.)

This chapter includes overall chemical composition of wood, methods of analysis, structure of hemicellulose components and degree of polymerization of carbohydrates. Tables of data are compiled for woods of several countries. Components include: cellulose (Cross and Bevan, holo-, and alpha-), lignin, pentosans, and ash. Data from more detailed analyses are presented for common temperate-zone woods and include the individual sugar composition, uronic anhydride, acetyl, lignin, and ash.

Penetration and Reactivity of Cell Wall Components

Rowell, Roger M.
In: Rowell, Roger M., ed. The chemistry of solid wood. Advances in chemistry series 207. Washington, DC: American Chemical Society; 1984: Chapter 4. (Complete book is available from American Chemical Society, 1155 Sixteenth Street NW., Washington, DC 20036. Cost: $49.95 for members; $79.95 for nonmembers; and $95.95 for foreign mailing.)

The author discusses chemical modification of wood to increase its resistance to biodegradation and photodegradation, to improve its dimensional stability, and to decrease its flammability depends on adequate distribution of reacted chemicals in the water-accessible regions of the cell wall. The chemicals used for modifying wood must be capable of swelling the wood to facilitate penetration and must react with the cell wall polymer hydroxyl groups under neutral or mild alkaline conditions at temperatures at or below 120°C.

21. Chemical Modification of Wood

Rowell, Roger M.
Forest Prod. Abstr. 6(12): 363-382; 1983.

Chemical modification of wood to impart resistance to termites, decay, and marine organisms, and increase dimensional stability is discussed and depends on adequate distribution of reacted chemicals in water-accessible regions of the cell wall.

22. Effects of Moisture on the Chemical Modification of Wood with Epoxides and Isocyanates

Rowell, Roger M.; Ellis, W. Dale
Wood and Fiber Sci. 16(2): 257-267; 1984.

The effects of moisture on the reaction of epoxides and isocyanates with wood were investigated. Ponderosa pine at 0%, 5%, and 10% equilibrium moisture contents was reacted separately with either propylene oxide or butylene oxide catalyzed with triethylamine, or with butyl isocyanate catalyzed with dimethylformamide. Five successive treatments were performed while recycling the treatment solutions on specimens with 5% and 10% equilibrium moisture contents. Grinding and extracting the treated wood showed significant losses of nonbonded chemical at these original moisture levels.

23. Drying Produces Easily Hydrolyzed Cellulose

Springer, Edward L.
Cellulose Chem. Technol. 17(5): 525-529; 1983.

Hydrolysis of fresh, never-dried southern red oak wood (*Quercus falcata*) was compared with that of a matching sample dried in a vacuum oven at 70°. The samples were hydrolyzed for 5.0 min using 0.40 percent H_2SO_4 at a liquid to solid ratio of 3:1 and a temperature of 170°. Drying the wood produced an easily hydrolyzed cellulose fraction, but had no significant effect on the rates of hydrolysis of hemicelluloses.

24. Application of ESCA to Evaluate Wood and Cellulose Surfaces Modified by Aqueous Chromium Trioxide Treatment

Williams, R. S.; Feist, W. C.
Colloids and Surfaces 9: 253-271; 1984.

The specific objective of research reported here was to differentiate between chromium-cellulose interactions and chromium interactions with other wood components, such as lignin and extractives. These interactions included the changes in surface chemistry during chromic acid treatment of wood and pure cellulose. Chromium-hemicellulose reactions were not addressed in this preliminary investigation. The critical tool used to evaluate these surface interactions was Electron Spectroscopy for Chemical Analysis (ESCA). Through this technique, subtle changes in surface composition and chemistry were detected through non-destructive, in situ analysis. Subsequent research will address other aspects of chromium-wood interactions and surface modification of wood.

25. New Developments in Rosin Ester and Dimer Chemistry

Zinkel, Duane F.
Naval Stores Review, Nov.-Dec. 1983: 12-13.

Recent work has led to important new discoveries in the chemistry of rosin esters and dimers. Research on new rosin esters was prompted by a need for analytical model compounds for rosin dimer research. In the course of this work, a novel method was developed for the esterification of rosin acids.

The Chemistry of Wood Strength

Winandy, Jerrold E.; Rowell, Roger M.
In: Rowell, Roger M., ed. The chemistry of solid wood. Advances in chemistry of solid wood. Advances in chemistry series 207. Washington, DC: American Chemical Society; 1984: Chapter 5. (Complete book is available from American Chemical Society, 1155 Sixteenth Street NW., Washington, DC 20036. Cost: $49.95 for members; $79.95 for nonmembers; and $95.95 for foreign mailing.)

The chemical components of wood that are responsible for mechanical properties can be viewed from three levels: macroscopic (cellular), microscopic (cell wall), and molecular (polymeric). This chapter presents a theoretical model to explain the relationship between the mechanical properties and the chemical components of wood. This model is then used to describe the effects of altered composition on those mechanical properties. Many of the theories presented are unproven.

degradation and protection

26. Field Trials of Chemicals to Control Sapstain and Mold On Yellow-Poplar and Southern Yellow Pine Lumber

Cassens, Daniel L.; Eslyn, Wallace E.
Forest Prod. J. 33(10): 52-56; 1983.

The effectiveness of 3-iodo-2-propynyl butyl carbamate (IPBC), sodium pentachlorophenate (Na-PCP), and copper-8-quinolinolate (PQ-8) in prevention of sapstain and mold on freshly cut yellow-poplar and southern yellow pine lumber when bulk-piled or stickered under field conditions was investigated.

Does Sapstain Rob Summertime Profits?

Cassens, Daniel L.; Eslyn, Wallace E.
Northern Logger & Timber Processor 32(11): 26-29; 1984. (Available from Information Services Division, Kurt F. Wendt Library, College of Engineering, University of Wisconsin-Madison, 215 North Randall Avenue, Madison, WI 53706.)

The authors discuss the causes of sapstain degrade in wood and methods to prevent such degrade in wood.

Finishing Hardwood Floors and Millwork

Cassens, Daniel L.; Feist, William C.
In: Roy M. Carter, ed. Finishing Eastern Hardwoods. Proceedings No. 7318. Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705; 1983: 86-95. (Available from: Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705.)

27. Fungal Decolorization of Bleach Plant Effluents

Chang, H.-m.; Joyce, T. W.; Campbell, A. G.; Gerrard, E. D.; Huynh, Van-Ba; Kirk, T. K. In: Higuchi, T.; Chang, Hou-min.; Kirk, T. Kent, eds.
Recent advances in lignin biodegradation: Proceedings of an international seminar, organized under the auspices of the U.S.-Japan cooperative science program; 1983 May 31-June 2; Kyoto, Japan. Toyko, Japan: Uni Publishers Co., Ltd.; 1983; 257-268.

A bench scale evaluation of a fungal decolorization process for pulp mill and bleach plant effluents using the white-rot fungus *Phanerochaete chrysosporium* is reviewed. When immobilized in a rotating biological contactor (RBC) reactor, the fungus can significantly reduce the color of effluents produced by integrated kraft pulp and paper mills. Color is due to polymeric, chlorinated lignin degradation products.

28. Decay in Mine Timbers. Part III. Species-Independent Stress Grading

Chudnoff, M.; Eslyn, W. E.; McKeever, D. B.
Forest Prod. J. 34(3): 43-50; 1984.

This report assesses the viability of two nondestructive devices, the Pilodyn and James Electronics V-meter, for sorting or grading groups of mine timbers with and without species identification. The results suggest that species-independent stress grading could have application not only to wood products from mixed woodlands of temperate regions but to the highly heterogeneous timber resources of the lowland tropics.

Finishing Wood For Exterior Use

Feist, William C.
In: Roy M. Carter, ed. Finishing Eastern Hardwoods. Proceedings No. 7318. Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705; 1983: 185-198. (Available from Forest Products Research Society, 2801 Marshall Court, Madison, WI 53705.)

The performance of hardwoods in exterior use will be greatly affected by species, by finishes, by construction practices, and by the degree of protection from prolonged wetting. The author discusses the finishing and protective measures used for wood in exterior use.

29. Painting and Finishing Wood For Use Outdoors

Feist, William C.
In: New Ideas Materials Procedures. Proceedings of Seventh Annual Educational Conference; 1984 February 5-8; Baltimore, MD. Washington, DC; American Society of Home Inspectors, Inc. 1984: A1-A27.

The primary function of any wood finish is to protect the wood surface, help maintain appearance, and provide cleanability. The author discusses painting and finishing processes of wood for outdoor use.

30. The Role of Water Repellents and Chemicals in Controlling Mildew on Wood Exposed Outdoors

Feist, William C.
USDA Forest Serv. Res. Note FPL-0247, 1984. p. 15.

The objectives of the work reported here were to: 1) investigate different chemicals for use as mildewcides in a clear natural wood finish, and 2) determine the effectiveness and/or synergistic effect of water repellents used in combination with chemicals in a natural wood finish. The formulations studied were applied to wood by dipping, and the treated specimens exposed outdoors above ground at three exposure sites with greatly varying climates.

Weathering and Protection of Wood

Feist, William C.

In: Proceedings, seventy-ninth annual meeting of the American Wood-Preservers' Association; 1983 April 17-20; Kansas City, MO. Stevensville, MD: American Wood-Preservers' Association; 1983; 79: 195-205. (Available from Information Services Division, Kurt F. Wendt Library, College of Engineering, University of Wisconsin-Madison, 215 North Randall Avenue, Madison, WI 53706.)

The author discusses how wood exposed to the weather can be protected by paints, stains, or varnishes. Paints provide the most protection to exposed wood surfaces, since they are generally opaque to the degradative effects of ultraviolet light and protect wood to some degree against wetting. Paint performance may vary greatly on different woods. Pigmented stains also provide durable, easily refinished finishes for wood exposed outdoors. Varnishes generally do not perform satisfactorily and require frequent refinishing.

Chemistry of Weathering and Protection

Feist, William C.; Hon, David N.-S.

In: Rowell, Roger, M., ed. The chemistry of solid wood. Advances in chemistry series 207. Washington, DC: American Chemical Society; 1984: Chapter 11. (Complete book is available from American Chemical Society, 1155 Sixteenth Street NW., Washington, DC 20036. Cost: $49.95 for members; $79.95 for nonmembers; and $95.95 for foreign mailing.)

Wood exposed to the outdoors undergoes photodegradation and photooxidative degradation in the natural weathering process. UV light interacts with lignin to initiate discoloration and deterioration. This chapter updates and consolidates past literature on the weathering and protection of wood, and emphasizes recent and new research in this area.

Wood Siding—Installing, Finishing, Maintaining

Feist, W. C.; Oviatt, A. E.

Home and Garden Bull. 203. Washington, DC: U.S. Department of Agriculture, Forest Service; revised December 1983. 24 p. (Copies available from Government Printing Office, 710 North Capitol Street, Washington, DC 20402.)

The authors describe types of wood siding and installation of wood siding. Also described is the finishing and maintenance of wood siding.

Treating and Drying Composite Lumber with Waterborne Preservatives.
Part 1. Short Specimen Testing

Gaby, Louis I.; Gjovik, Lee R.

Forest Prod. J. 34(2): 23-26; 1984. (Available from Publications distribution, USDA Forest Service, Southeastern Forest Experiment Station, 200 Weaver Blvd., Ashville, NC 28804. No charge.)

Two groups of composite lumber with a particleboard core and veneer surfaces were fabricated to determine the treatability of this material with waterborne preservatives. One group was made from particleboard and veneer of southern pine, which is easy to treat. The second group was made from heart Rocky Mountain Douglas-fir, which is very hard to treat. Two waterborne preservatives, chromated copper arsenate (CCA) and ammoniacal copper arsenate (ACA), were used to treat specimens.

31. Treatability of Southern Pine, Douglas-Fir, and Engelmann Spruce Heartwood with Ammoniacal Copper Arsenate and Chromated Copper Arsenate

Gjovik, Lee R.

In: Proceedings, seventy-ninth annual meeting of the American Wood-Preservers' Association; 1983 April 17-20; Kansas City, MO. Stevensville, MD: American Wood-Preservers' Association; 1983; 79: 18-30.

Little is known about the benefit of the sometimes shallow preservative penetration obtained in southern pine, Douglas-fir, and Engelmann spruce heartwood treated by conventional methods. This lack of knowledge impedes development of acceptance standards for treated heartwood.

This study determined, by treatment and chemical analysis of the material and by ground contact exposure, the effectiveness of preservative-treated plywood and solid wood of southern pine, Douglas-fir, and Engelmann spruce heartwood.

32. Comparison of Wood Preservatives in Stake Tests (1983 Progress Report)

Gjovik, L. R.; Gutzmer, D. I.
USDA Forest Serv. Res. Note FPL-02. 1983. 89 p.

Compares wood preservatives used on test stakes of southern pine sapwood on five different sites.

33. Measurement of Cellulase Activity in Brown- and White-Rot Fungi on Dyed Cellulose

Highley, Terry L.
Material und Organismen 18(3):161-170; 1983.

One of the most common culture methods for determining cellulolytic activity of fungi has been to monitor the clearing of cellulose in an opaque agar medium. The purpose of this work is to determine if cellulolytic activity of brown-rot fungi unable to clear cellulose agar can be detected using a dyed-cellulose agar method, and to determine the effect of various cultural conditions on breakdown of dyed cellulose by brown- and white-rot fungi.

34. Ultrastructural Aspects of Cellulose Decomposition by White-Rot Fungi

Highley, Terry L.; Murmanis, Lidija L.; Palmer, John G.
Holzforschung 38(2): 73-78; 1984.

Five white-rot fungi were grown on cellulose fibers and the degradation was observed by scanning and transmission electron microscopy. The white-rot fungi produced hyphal sheaths when grown on cellulose fibers, but sheaths generally were not present between the hyphae and fibers. Autolyzing hyphae and diffusion of cytoplasmic material into sheath or fiber was seldom observed.

35. Electron Microscopy of Cellulose Decomposition by Brown-Rot Fungi

Highley, T. L.; Murmanis, L.; Palmer, J. G.
Holzforschung 37(6): 271-277; 1983.

This study is a report of the microscopic examination of the progressive degradation of isolated cellulose by 11 economically important brown-rot fungi to establish that the visual patterns of change in cellulose structure produced by the various brown-rot fungi during decomposition are similar. Knowledge of the manner in which brown-rot fungi attack cellulose will aid in understanding the basic requirements for wood degradation. This will serve as a foundation for the development of satisfactory methods to prevent wood decay.

Effect of Coating Systems on the Vaporization of Pentachlorophenol from Treated Wood

Ingram, Jr., Leonard L.; McGinnis, Gary D.; Pope, Paula M.; Feist, William C.
In: Proceedings, sevety-ninth annual meeting of the American Wood-Preservers' Association; 1983 April 17-20; Kansas City, MO. Stevensville, MD: American Wood-Preservers' Association; 1983; 79: 32-41. (Available from Information Services Division, Kurt F. Wendt Library, College of Engineering, University of Wisconsin-Madison, 215 North Randall Avenue, Madison, WI 53706.)

Possible health effects associated with the exposure of humans to air-borne pentachlorophenol (penta) have focused attention on the use of wood treated with this chemical inside homes. The objective of the study reported here was to determine the effectiveness of different coating systems in reducing the levels of air-borne penta vaporizing from specimens dip-treated with penta in mineral spirits and pressure-treated with penta in P9 type A oil or methylene chloride.

36. Lignin Biodegradation: Importance and Historical Research Perspective

Kirk, T. Kent
In: Higuchi, T.; Chang, Hou-min.; Kirk, T. Kent, eds. Recent advances in lignin biodegradation: Proceedings of an international seminar, organized under the auspices of the U.S.-Japan cooperative science program; 1983 May 31-June 2; Kyoto, Japan. Tokyo, Japan: Uni Publishers Co., Ltd.; 1983: 1-11.

Lignin biodegradation occupies a central position in the earth's carbon cycle, because most renewable carbon is either in lignin or in compounds protected by lignin from enzymatic degradation (cellulose and hemicelluloses).

In this opening chapter, the author's first purpose is to point out why there is an accelerating interest in this area of research. His second purpose is to review briefly the 60-year development of knowledge in this field, in an attempt to put our present efforts, described in subsequent chapters, into an historical perspective.

Biological Decomposition of Solid Wood

Kirk, T. Kent; Cowling, Ellis B.
In: Rowell, Roger M., ed. The chemistry of solid wood. Advances in chemistry series 207. Washington, DC: American Chemical Society; 1984: Chapter 12. (Complete book is available from American Chemical Society, 1155 Sixteenth Street NW., Washington, DC 20036. Cost: $49.95 for members; $79.95 for nonmembers; and $95.95 for foreign mailing.)

Decomposition of wood is an important part of the carbon cycle of nature. This chapter presents an overview of the biological decomposition of wood. It begins with a brief description of the major types of wood destruction and their causal agents, and it continues with a description of the progressive changes that take place in wood as it is decomposed. Special emphasis is given to the chemistry and biochemistry involved. The chapter ends with a brief treatment of how wood in use can be protected from decomposition and some beneficial uses of wood-decomposing organisms.

37. Photochemical Degradation of Acetylated, Methylated, Phenylhydrazine-Modified, and ACC-Treated Wood

Kalnins, M. A.
J. Appl. Polym. Sci. 29: 105-115; 1984.

The performance of clear finishes would be greatly enhanced if wood under clear, ultraviolet-transparent coatings could be protected from photodegradation. The objective of this study was to determine whether acetylation or methylation of the wood and whether reaction with phenylhydrazine or treatment with acid copper chromate would impart resistance to photodegradation by longwave UV light. Infrared (IR) and ultraviolet (UV) spectra, analysis of wood before and after irradiation, and quantitative determination of volatile degradation products were used to measure degradation.

38. An Electron Microscopy Study of Western Hemlock Degradation by the White-Rot Fungus *Ganoderma applanatum*

Murmanis, Lidija; Highley, Terry L.; Palmer, John G.
Holzforschung 38(1): 11-18; 1984.

Researchers at the Forest Products Laboratory are studying degradation of wood by fungi in order to create better means for protecting our wood resource. This study used electron microscopy to observe the degradation of western hemlock by the white-rot fungus *Ganoderma applanatum*. The goal was to elaborate and support the current views on how enzyme systems work and how fungi penetrate and morphologically change wood cells.

39. Bonding Fire Retardants to Wood. Part I. Thermal Behavior of Chemical Bonding Agents

Rowell, Roger M.; Susott, Ronald A.; DeGroot, William F.; Shafizadeh, Fred
Wood and Fiber Sci. 16(2): 214-223; 1984.

Bonding chemicals to wood can alleviate the problem of leachability, but the effects of such bonding on wood properties are not yet well researched. To overcome the problems of leachability, corrosivity, hygroscopicity, and strength reduction from traditional fire-retardant treatments, the Forest Products Laboratory has initiated a program to investigate bonding fire retardants to wood.

40. The Level of Respirable Arsenic on the Surface of Treated Wood in Service

Saur, James M.; Walcheski, Paul J.; Gjovik, Lee R.
In: Proceedings, seventy-ninth annual meeting of the American Wood-Preservers' Association; 1983 April 17-20; Kansas City, MO. Stevensville, MD: American Wood-Preservers' Association; 1983; 79: 66-70.

A sampling method and analytical procedures were developed to determine the amount of respirable arsenic existing as deposits on the surface of arsenically treated wood. Using this method the respirable arsenic content was determined in sludge samples taken from treated wood in the eastern and midwestern United States.

41. Biodeterioration and Strength Reductions in Preservative Treated Aspen Waferboard

Schmidt, Elmer L.; Hall, Henry J.; Gertjejansen, Roland O.; Carll, C. G.; DeGroot, Rodney C.
Forest Prod. J. 33(11/12): 45-53; 1983.

Experimental aspen waferboards, bonded with liquid or powdered phenolformaldehyde resins and treated by various methods with a wide selection of preservatives, were tested for fungal resistance in accelerated laboratory trials. Mold growth on the surface as well as weight and strength losses due to the actions of decay fungi were determined.

A range of protection was noted with no preservative system exceeding the efficacy of the inorganic salt formulations. Averaged overall treatments, strength loss and weight loss are well correlated. Field exposures of effective treatments are underway.

42. Biodegradation of Guaiacyl and Guaiacyl-Syringyl Lignins in Wood by *Phanerochaete chrysosporium*

Tai, D.; Terasawa, M.; Chen, C.-L.; Chang, H-m.; Kirk, T. K.
In: Higuchi, T.; Chang, Hou-min.; Kirk, T. Kent, eds. Recent advances in lignin biodegradation: Proceedings of an international seminar, organized under the auspices of the U.S.-Japan cooperative science program; 1983 May 31-June 2; Kyoto, Japan. Tokyo, Japan: Uni Publishers Co., Ltd.; 1983: 44-63.

Both high and low molecular weight lignin degradation products were isolated from spruce and birch woods decayed by *Phanerochaete chrysosporium*. The high molecular weight fractions were characterized by GPC and ^{13}C NMR spectroscopy. The data indicated that both lignins were degraded at the macromolecular level by the fungus. Analysis of the ^{13}C NMR spectra resulted in elucidation of structural changes in the degraded via similar modes and pathways, which are discussed in terms of sidechain, aromatic ring and alkyl-phenyl cleavages.

Lignocellulose Degradation During the Life Cycle of *Agaricus bisporus*

Wood, D. A.; Leatham, G. F.
FEMS Microbiol. Lett. 20: 421-424; 1983. (Available from Information Services Division, Kurt F. Wendt Library, College of Engineering, University of Wisconsin-Madison, 215 North Randall Avenue, Madison, WI 53706.)

Lignocellulose degradation was monitored during the complete life cycle of the edible mushroom *Agaricus bisporus* grown on composted straw. Lignin and cellulose degradation were assayed by the use of ^{14}C-labelled lignin and cellulose. *Agaricus* degraded both polymers but cellulose degradation was more extensive. No large change in the rate of lignin degradation occurred during the life cycle.

design data

43. Nondestructive Screening of Hardwood Specialty Blanks

Dean, Margery A.; Kaiserlik, Joseph H.
Forest Prod. J. 34(3): 51-56; 1984.

The purpose of this study was to evaluate the potential of several possible nondestructive testing (NDT) techniques for screening hardwood specialty blanks on the basis of strength.

44. A Cumulative Damage Model for Lumber

Gerhards, Charles C.; Link, Carol L.
In: Chen, W. F.; Lewis, A.D.M. Recent advances in engineering mechanics and their impact on civil engineering practice: Proceedings of the Fourth Engineering Mechanics Division Specialty Conference; Vol. 2. 1983 May 23-25; West Lafayette, IN. New York: American Society of Civil Engineers; 1983: 940-943.

Wood is known to creep under load. If the load is large, creep can eventually lead to rupture. This paper evaluates an exponential cumulative damage model for different load histories for wood.

45. Effect of Loading Rate on Tensile Strength of Douglas-fir 2 by 6's

Gerhards, Charles C.; Marx, Catherine M.; Green, David W.; Evans, James W.
Forest Prod. J. 34(4): 23-26; 1984.

The object of this study was to evaluate the effect of loading at 10 and 25 times the standard rate of loading in tension, and to support early acceptance of a more rapid rate as standard.

46. Effect of Shock Loading From Series Testing on Tensile Strength of Lumber and Connector Systems

Gerhards, C. C.; Pellerin, R. F.
Forest Prod. J. 34(1): 38-43; 1984.

This study determines the effect of shock loading on tensile strength of lumber and to test the efficacy of the transfer of tensile loads to specimens through pin connections in sections finger-jointed to the ends of the specimens. A secondary objective was to determine the magnitude of shock-wave induced stresses (stress waves).

47. Calculating Apparent Reliability of Wood Scaffold Planks

Gromala, David S.
Structural Safety 2: 47-57; 1984.

Current safety requirements of the American National Standards Institute (ANSI A10.8) for wood scaffold planks are rooted in a history of generally good performance. This paper relates published requirements for wood scaffold planks in codes and standards to the allowable bending stresses published by lumber grading agencies based on a set of assumptions recommended by the ad hoc group. A methodology is proposed, based on requiring equivalent structural reliability, for designing alternative wood-based scaffold planks.

48. Estimating the Concomitance of Lumber Strength Properties

Johnson, Richard, A.; Galligan, William L.
Wood and Fiber Sci. 15(3): 235-244; 1983.

Although lumber bending and tensile strength properties have been extensively studied, their cofunctioning—so important to the performance of structures—is not well understood. A novel application of proofloading is now available to wood scientists who need to estimate the cofunctioning of two strength properties. This technique and a statistical analysis of the data developed from the proofload experiments are presented.

49. An Approximate Lower Tolerance Bound for the Three-Parameter Weibull Applied to Lumber Property Characterization

Johnson, Richard A.; Haskell, James H.
Statistics & Probability Lett. 2: 67-76; 1984.

The authors investigate a large sample approach for obtaining tolerance bounds where the underlying population is a three-parameter Weibull distribution. Accurate tolerance bounds could play an important role in the development of lumber standards. Properties of the maximum likelihood based approach are compared with those of the standard nonparametric tolerance procedure. The asymptotic normal approximation to the tolerance bound was found to be inadequate for most of the cases considered.

50. Sampling Properties of Estimators of a Weibull Distribution of Use in the Lumber Industry

Johnson, Richard A.; Haskell, James H.
The Can. J. Stat. 11(2): 155-169; 1983.

The authors considered maximum-likelihood estimators of the three parameters in the Weibull distribution. Motivated by an application regarding the determination of a lower percentile of the strength of dimension lumber, they investigated the sampling properties of these estimators. The main purpose in this paper was to investigate maximum-likelihood estimation for the Weibull model.

51. Lateral Resistance of Nailed Joints—A Test Method

Liu, J. Y.; Soltis, L. A.
Forest Prod. J. 34(1): 55-60; 1984.

The strength and stiffness of light-frame building components depend on the lateral resistance of the nailed joints between the connected members. Use of the Standard ASTM test to determine lateral resistance has resulted in controversy due to eccentric loading. This study describes a new test apparatus which minimizes the effect of eccentric loading.

52. Full-Scale Testing and Structural Evaluation of a Truss-Framed Assembly

Luttrell, Larry D.; Tuomi, Roger L.
Forest Prod. J. 34(1); 64-68; 1984.

The truss-framed system can lead to greater efficiency in construction. In order to determine if conventional truss analysis techniques are applicable to this system, a full-scale assembly was evaluated under floor and roof loading. Measured deflections were within 10 percent of those predicted, which indicates that designers can use available techniques to predict deflection performance.

Noise Control

Oviatt, Jr., Alfred E.
University of Illinois SHC-BRC, F5.0 Council Notes 5(4): 1-8; 1983. (Available from Small Homes Council-Building Research Council, University of Illinois at Urbana-Champaign, One East Saint Mary's Road, Champaign, IL 61820.)

The author discusses various ways of controlling unwanted noise in the home through careful planning, design, and construction.

53. An Iterative Procedure for Finite-Element Stress Analysis of Frictional Contact Problems

Rahman, M. U.; Rowlands, R. E.; Cook, R. D.; Wilkinson, T. L.
Computers & Structures 18(6): 947-954; 1984.

A simple, efficient, versatile and easily adaptable, iterative finite-element technique is described for solving frictional contact problems. The method is based on logical steps to establish the contact geometry and regions of slip and nonslip. Unlike previous techniques, the approach can be extended readily to multiple contact surfaces.

54. Purdue Plane Structures Analyzer II: A Computerized Wood Engineering System

Suddarth, Stanley K.; Wolfe, Ronald W.
USDA Forest Serv. Gen. Tech. Rep. FPL-40. 1984.

The Purdue Plane Structures Analyser (PPSA) is a computer program developed specifically for the analysis of wood structures. The program offers several options for the analysis of member capacity, depending on lateral support conditions, strength property variations, and critical load assumptions. This report provides guidelines for program use and interpretation of results and will be helpful to structural engineers and designers.

55. Roof Loads for Reliability Analysis of Lumber Properties Data

Thurmond, Michael B.; Woeste, Frank E.; Green, David W.
Wood and Fiber Sci. 16(2): 278-297; 1984.

With load information reported in previous studies, distributions of maximum lifetime roof loads are developed in a form suitable for use in reliability analyses of lumber properties data. A lognormal distribution is chosen as best representing normalized maximum lifetime roof snow load. Examples are given in which contrasting lumber data sets are compared using the calculated load distributions.

56. Loss of Torsional Stiffness Caused by Beam Loading

Zahn, John J.
J. Struct. Eng. 110(1): 47-54; 1984.

The design of large interconnected systems of roof beams often involves the support of one beam by adjacent beams in-line. The support condition for the center beam is one of simple support with elastic axial rotation restraint. The stiffness of that elastic restraint influences the lateral-torsional buckling load of the center member; the value of that stiffness is derived from the torsional rigidity of the two outer beams. The author discusses the torsional rigidity of bending members.

fire

Chemistry of Fire Retardancy

LeVan, Susan L.
In: Rowell, Roger M., ed. The chemistry of solid wood. Advances in chemistry series 207. Washington, DC: American Chemical Society; 1984: Chapter 14. (Complete book is available from American Chemical Society, 1155 Sixteenth Street NW., Washington, DC 20036. Cost: $49.95 for members; $79.95 for nonmembers; and $95.95 for foreign mailing.)

Fire retardancy of wood involves a complex series of simultaneous chemical reactions, the products of which take part in subsequent reactions. This chapter presents a literature review of the investigations into the mechanisms, a discussion of test methods used for determining fire retardancy, the various formulations used to make wood fire retardant, and the research needs in the field of fire retardancy.

57. Use of Coatings to Improve Fire Resistance of Wood

White, Robert H.
In: Standard Tech. Publ. 826(24-39), Philadelphia, PA: American Society for Testing and Materials, 1984.

Currently used fire retardant coatings for wood products reduce flame spread; they are not designed specifically to provide fire resistance. Fire resistive coatings designed for steel and foam plastics generally are not recommended for wood. Small nonload-bearing fire resistance tests were conducted in this study to determine the fire resistance of eight commercially available fire retardant and fire resistive coatings when applied to a wood product. The fire resistance data reported in this paper should aid in future considerations of fire resistive coatings in wood construction.

general

Econometric versus Univariate and Bivariate Time-Series Forecasts: The Case of Softwood Lumber Imports

Buongiorno, Joseph; Brannman, Lance; Bark, Taeho
Forest Sci. 30(1):194-208; 1984. (Available from Dr. Joseph Buongiorno, School of Forestry, University of Wisconsin, Madison, WI 53706. No charge.)

Modeling the North American Paper Industry with Extension to International Trade

Buongiorno, Joseph; Gilless, James K.
Paper from the 2nd North American Regional Meeting, Arlington, VA; 1983. pp. 117-133. (Available from USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, P.O. Box 3890, Portland, OR 97208. No charge.)

Econometric Models of United States Demand for Paper and Paperboard

Buongiorno, Joseph; Kang, Young Moo
Wood Sci. 15(2):119-126; 1982. (Available from Information Services Division, Kurt F. Wendt Library, College of Engineering, University of Wisconsin-Madison, 215 North Randall Avenue, Madison, WI 53706.)

Concepts Used in a Regionalized Model of Pulp and Paper Products and Trade

Buongiorno, Joseph; Gilless, James K.
(Available from Dr. Joseph Buongiorno, School of Forestry, University of Wisconsin, Madison, WI 53706. No charge.) Chapter in Forest Sector Models published by A. B. Academic Publishers, United Kingdom, pp. 57-70; 1983.

A Model of International Trade of Forest Products (GTM-1)

Buongiorno, Joseph; Gilless, James K.
A working paper #WP8363. The Forest Sector Project, International Institute for Applied Systems Analysis, 2361 Laxenburg, Austria. 1983. (Available from Dr. Joseph Buongiorno, School of Forestry, University of Wisconsin, Madison, WI 53706. No charge.)

United States Demand for Hardwood Plywood Imports: A Distributed Lag Model

Chou, Jieh-Jen; Buongiorno, Joseph
Agricultural Systems 8 (1982), pp. 225-239. (Available from Dr. Joseph Buongiorno, School of Forestry, University of Wisconsin, Madison, WI 53706. No charge.)

58. Trends in the Production and Consumption of Major Forest Products in the United States

McKeever, David B.; Cherilyn A. Hatfield
USDA, Forest Serv. Resour. Bull. FPL-14; 1984.

This report presents statistical information in tables and graphs on past trends in the production, consumption, and foreign trade of forest products in the United States. It follows the flow of wood through the U.S. economy from the Nation's forests, through the primary and secondary wood-processing industries, to the final end uses.

59. Economics of Increasing the Use of Recycled Corrugated Fiber in Linerboard

Ince, Peter J.; Klungness, John H.
In: Proceedings of the Technical Association of the Pulp and Paper Industry 1983 Pulping Conference; 1983 October 24-26; Houston, TX. Atlanta, GA: TAPPI Press; 1983: 719-725.

This study analyzes the economics of increasing the use of recycled fiber to up to 50% of fiber furnish. On the bases of fiber raw material costs, various process costs, and capital costs, increasing the use of recycled fiber is economical compared to the alternative of expanding pulping capacity.

60. Prospective Markets for Spruce-Fir in Residential Construction in the 1980's and Beyond

Marcin, Thomas C.
In: Corcoran, Thomas J.; Gill, Douglas R., eds. Proceedings: Recent Advances in Spruce-Fir Utilization Technology; 1983 August 17-19; [Orono, ME]. Soc. Am. Forest. Pub. No. 83-13. [Bethesda, MD: American Society of Foresters; 1983]: 175-183.

New residential construction provides the largest single market for most wood products in the United States. The author discusses the prospective markets for Spruce-fir in residential construction in the 1980's and beyond.

61. Measuring Changes in Forest Products Demands for Projecting Trends in Forest Resources

Marcin, Thomas C.; McKeever, David B.
In: Bell, John, F.; Atterbury, Toby, eds. Renewable Resource Investories for Monitoring Changes and Trends: An International Conference; 1983 August 15-19; Corvallis, OR. Corvallis, OR: Oregon State University; 1983: 124-128.

This paper examines methods for measuring change in forest resources demand as related to long-range trends in demographic economic and social variables. A conceptual framework for relating changes in forest resource demands to changes in forest inventory is presented.

62. The Softwood Plywood Industry in the United States, 1965-82

McKeever, David B.; Meyer, Gary W.
USDA Forest Serv. Resour. Bull. FPL-13; 1984.

This report examines the current status of the U.S. softwood plywood industry as well as reasons for regional capacity and production shifts. Estimates of individual plant capacities for the years 1965, 1970, 1975, and 1982 are presented. Production, imports, exports, apparent domestic consumption, and industry raw material requirements are examined.

Value Added Analysis—A Method of Technological Assessment in the U.S. Forest Products Industry

Ringe, James M.; Hoover, William L.
(Available from William L. Hoover, Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN 47907.)

Who Uses Wood-Burning Equipment and Why?

Skog, Kenneth; Watterson, Irene
Wood 'n Energy 4(3):81-84; 1984. (Available from Libraries.)

The authors discuss the different types of wood-burning equipment and the users of that equipment.

63. Changes in Postwar U.S. Lumber Consumption Patterns

Spelter, Henry; Phelps, Robert B.
Forest Prod. J. 34(2): 35-41; 1984.

This paper summarizes post World War II trends in key U.S. lumber markets including residential and nonresidential construction, manufacturing, and shipping. It enumerates changes in technology and competition among substitute products that have caused lumber use to decline in per unit terms for most applications. Data from numerous previous market studies have been compiled and used to estimate use rates of lumber in various markets between 1948 and 1981.

64. Factors Determining Lumber Recovery in Sawmilling

Steele, Philip H.
USDA Forest Serv. Gen. Tech. Rep. FPL-39; 1984.

Lumber volume recovery in sawmilling is determined by a confusing interaction of several factors. The author identifies and discusses in detail seven factors influencing lumber recovery. Past and current research is cited, and examples are given to illustrate the points made.

65. Estimating Timber Production for U.S. Farm and Other Private Forests

Stone, Robert N.; McKeever, David B.
In: Royer, Jack P.; Risbrudt, Christopher C., eds. Nonindustrial Private Forests: A Review of Economic and Policy Studies: Symposium Proceedings; 1983 April 19-20; Duke University, Durham, NC: Duke University; 1983: 37-50.

This paper demonstrates how ratios developed from conventional forest survey statistics can be used to compare timber harvesting and timber growing performances of farm and other private forest ownership with other ownership classes.

Wood

Wegner, Theodore H.; Baker, A. J.; Bendtsen, B. A.; Brenden, J. J.; Eslyn, W. E.; Harris, J. F.; Howard, J. L.; Miller R. B.; Pettersen, R. C.; Rowe, J. W.; Rowell, R. M.; Simpson, W. T.; Zinkel, D. F.
Reprinted from Kirk-Othmer: Encyclopedia of Chemical Technology, Volume 24, Third Edition. John Wiley & Sons, Inc. (Complete book available from John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10016.)

66. Evaluation of Live Oak Submerged Underwater for 50 Years and Proposed for Use in Rebuilding the U.S.S. Constitution

Winandy, Jerrold E.
Forest Prod. J. 34(5): 61-63; 1984.

Live oak timber stored under fresh water in New Hampshire for over 50 years was evaluated for possible use as structural framing in repairs on the U.S.S. Constitution. The material was found to be unsuitable for structural uses onboard ship. The physical and mechanical properties specifically evaluated were: The material and its present properties; the feasibility of using this material for structural purposes; and the feasibility of using this material for display purposes either onboard the ship or at a naval museum in lieu of its use as structural material.

mycology

67. The Genus *Candelabrochaete (Corticiaceae)* in North America and a Note on *Peniophora Mexicana*

Burdsall, Jr., Harold H.
Mycotaxon 19: 389-395; January-March 1984.

Studies of wood-rotting Basidiomycetes for the purpose of clarifying taxonomic limits and biological similarities or differences among the taxa led the author to investigate the genus *Phanerochaete* Karst., a genus containing numerous white-rot species. As a result of a previous study, a key to and descriptions of the North American species of *Candelabroachaete* and a discussion of *Pe. mexicana* are presented here.

68. Fungi Associated with Decayed Wood in Stored Willow and Cottonwood Logs

Eslyn, Wallace, E.; Lombard, Frances F.
Mycologia 76(3): 548-550; 1984.

This study attempts to complete identification of the unknown isolates because more wood products-associated Basidiomycetes are now identifiable in culture. Knowledge of the fungi frequently associated with deterioration of wood in different products is of value in that it can be used to choose test fungi for inclusion in decay control investigations.

69. On *Piloderma bicolor* in North America and Its Relationship to Piloderma byssinum

Larsen, Michael J.
Mycologia 75(6): 1092-1093; 1983.

The author discusses the issues of the application of the name *P. bicolor*, its proposed synonymy, and its relationship to *P. byssinum* which are taken up here.

70. Notes on Laeticorticioid Fungi

Larsen, Michael J.
Mycologia 76(2): 353-355; 1984.

The author's purpose here was to examine further the taxonomic criteria used to delimit *Laeticorticium* Donk and *Dendrocorticium* Lars. et Gilbn., and to review the generic disposition of several *Laeticorticium* species from Europe and North America. The affinities of some of these species are not with laeticorticioid fungi, but rather with other major fungal groups.

71. Additional New Taxa of *Laeticorticium* (Aphyllophorales, corticiaceae)

Larsen, M. J.; Nakasone, K. K.
Mycologia 76(3): 528-532; 1984.

Three new species of *Laeticorticium* from North America are proposed, *L. floridense* and *L. cremeo-albidium* from Florida, and *L. efibulatum* from Mississippi. Basidiocarp and cultural descriptions of each species supplemented by line drawings are presented.

72. Taxonomy of *Crustoderma* (Aphyllophorales, Corticiaceae)

Nakasone, K. K.
Mycologia 76(1): 40-50; 1984.

The genus *Crustoderma* is emended to include nine species, and all, except *C. longicystidium*, are associated with brown-rot decay of wood. Two new species, *C. carolinense* and *C. marianum*, are described and illustrated. New combinations of *C. corneum*, *C. longicystidium*, and *C. patricium* are proposed. *Peniophora weiri* Bres. is placed in synonymy with *C. dryinum*. Culture descriptions are included for *C. marianum* and *C. corneum*. A key to the species is provided.

73. Visualization of Hyphal Sheath in Wood-Decay Hymenomycetes. II. White-Rotters

Palmer, J. G.; Murmanis, L.; Highley, T. L.
Mycologia 75(6): 1005-1010; 1983.

Hyphae of each of five isolates representing five species of white-rot fungi had hyphal sheaths when grown in axenic culture. Whether white-rot fungi have sheaths as regularly as do brown-rot fungi and whether sheaths of white-rotters show distinctive differences from those of brown-rotters were investigated in this study.

74. Visualization of Hyphal Sheath in Wood-Decay Hymenomycetes. I. Brown-Rotters

Palmer, J. G.; Murmanis, L.; Highley, T. L.
Mycologia 75(6): 995-1004; 1983.

Several brown-rot fungi were studied with respect to formation of hyphal sheaths in axenic culture. The 12 fungi examined showed hyphal sheaths when grown on each type of solid substrate; in isolates grown in liquid media, sheaths were poorly demonstrated. Sheath structure varied among and within species, but a fine fibrillar texture was common to all.

packaging

75. Edgewise Compression of Paperboard: A New Concept of Lateral Support

Gunderson, Dennis
Appita 37(2): 137-141; 1983.

A new method and apparatus for measuring the response of paperboards to edgewise compressive loads has been developed and tested. The apparatus employs a new concept of adjustable lateral support which provides for uniform loading, essentially unrestrained deformation in three dimensions, and measurement of deformation independent of the loading or restraint systems. Test results are documented in a manner which permits reproduction of the full stress-strain curve, and are graphically compared to demonstrate the effect of changing lateral restraint pressure.

76. Moiré Strain Analysis of Paper

Rowlands, R. E.; Beazley, P. K.; Gunderson, D. E.
Tappi J. 66(8): 81-84; 1983.

Efficient use of paper products involves using modern aspects of materials science and engineering mechanics. Of several possible optical techniques, moire' demonstrates potential for full-field analysis of paperboard.

processing

77. High-Temperature Kiln-Drying of 4/4 Lumber from 12 Hardwood Species

Boone, R. Sidney
Forest Prod. J. 34(3): 10-18; 1984.

One-inch lumber of 12 hardwood species was kiln-dried by two schedules: 1) 230°F on stock green from the saw to 6 to 8 percent moisture content (MC) in 50 to 55 hours and 2) combination of conventional temperature (≤180°F) from the green condition to about 20 percent MC, then dried to 6 to 8 percent at 230°F requiring a total of 100 to 250 hours. The combination schedule decreased the drying degrade, but increased the kiln residence time over high temperature alone. However, the combination schedule reduced kiln residence for most species over completely drying at conventional temperatures.

78. Dimension Yields From Yellow-Poplar Lumber

Gilmore, Robert C.; Hanover, Stephen J.; Danielson, Jeanne D.
USDA Forest Serv. Gen. Tech. Rep. FPL-41; 1984.

This report provides users of yellow-poplar lumber with information on cutting yields by lumber grade. These data may be used for management control and for facilitating selection of the most economical grade or grade mix for specific cutting orders. The information is presented in the form of charts for calculating yields of various combinations of dimension sizes from each of the hardwood lumber grades.

79. In-Grade Testing: Impetus for Change in the Utilization of Structural Lumber

Green, David W.
In: Corcoran, Thomas J.; Gill, Douglas R., eds. Proceedings: Recent Advances in Spruce-fir Utilization Technology; 1983 August 17-19; [Orono, ME]. Soc. Am. Forest. Pub. No. 83-13. [Bethesda, MD: American Society of Foresters; 1983]: 191-200.

This paper summarizes a comprehensive program being conducted in the United States to evaluate the mechanical properties of visually graded structural lumber. Implementing the results in 1985 could affect the utilization of spruce and fir by altering their allowable properties relative to those of other species. Other potential changes in property assignment, marketing, and quality assurance procedures are reviewed which could also affect the utilization of spruce and fir.

80. Maximum Safe Initial Moisture Content for Press-Drying Oak Lumber Without Honeycomb

Simpson, William
Forest Prod. J. 34(5): 47-50; 1984.

The purpose of the study reported in this paper was to identify a more definite (than approximately 25%) initial MC below which red oak can be press-dried without developing honeycomb, and also identify a maximum safe initial MC for press-drying white oak.

81. Drying Wood: A Review

Simpson, William T.
Originally printed in *Drying Technology—An International Journal* as a two-part article: 1983-84.

This paper reviews the technology of wood drying and recent developments in the field. The importance of drying is reviewed first. Then the fundamentals of wood properties as they relate to drying are discussed.

82. Solar Dry Kiln for Tropical Latitudes

Simpson, William T.; Tschernitz, John L.
Forest Prod. J. 34(5): 25-34; 1984.

Developing countries that export forest products often lack the capital to build high-cost dry kilns. Many of these countries are in the tropics where solar radiation and ambient temperatures are high. The low-cost solar dry kiln described in this paper was designed and tested because solar dry kilns can be built and operated at low cost and have possible application in these countries.

pulp and paper

The Effect of White Water Recycle on Paper Strength Properties

Dullforce, Jon Patrick
(Available from: Miami University, Paper Science and Engineering Department, Oxford, OH 45056.)

83. Continuous On-Line Press Drying of High-Yield Oak Fiber for Linerboard

Horn, R. A.; Setterholm, V. C.
Tappi J. 66(6): 59-62; 1983.

The objective of this research was to demonstrate the feasibility of making an acceptable press-dried linerboard from 100%, high-yield, unrefined oak kraft pulp in a continuous mode.

84. A Nonlinear Theory for Elastic Plates With Application to Characterizing Paper Properties

Johnson, Jr., M. W.; Urbanik, T. J.
J. Appl. Mech. 51: 146-152; March 1984.

A theory of thin plates which is physically as well as kinematically nonlinear is developed and used to characterize elastic material behavior for arbitrary stretching and bending deformations. It is developed from a few clearly defined assumptions and uses a unique treatment of strain energy. An effective strain concept is introduced to simplify the theory to a special theory having fewer parameters and being capable of characterizing paper. A procedure is given for matching the special theory to edgewise compressive data of paperboard.

85. Fiber Separation With a Vaneless Spinning Disc: Application

Klungness, John H.; Oroskar, Anil R.; Crosby, E. Johansen
Tappi J. 67(6): 78-81; 1984.

Physical principles underlying present separation methods limit their effectiveness in upgrading certain papermaking furnishes. This study was undertaken to determine the feasibility of using a wide-lip disc (WLD) to upgrade wastepaper and high-density hardwood pulps.

Corrugated Fiberboard

Koning, John W. Jr.
In: Mark, R. E., ed. Handbook of physical and mechanical testing of paper and paperboard: Vol. 1. New York; Basel; Marcel Dekker, Inc.; 1983: Chapter 9. (Available from Marcel Dekker, Inc., 270 Madison Avenue, New York, NY 10016.)

86. The Influence of Starch on Drainage and Retention in Paperboard Mill Systems

Springer, A. M.; Chandrasekaran, S.; Wegner, T. H.
Tappi J. 67(2): 104-108; 1984.

Paper and paperboard mills have been closing their whitewater systems for various reasons. Such closure has resulted in the buildup of organic contaminants which lead to reduced effectiveness of polymeric additives. This study determined the effects that nonionic, anionic, and cationic starches have, either alone or in combination with polymeric additives, on drainage, retention, web vacuum dewatering response, and wet pressing response.

87. Polymeric Additive Performance in Closed Whitewater Systems

Wegner, T.
In: Proceedings, 1984 XXI EUCEPA International Conference; Torremolinos, Spain. Torremolinos, 14/17-Vol. 2; 1984: 437-451.

A serious problem resulting from more whitewater recycling is reduced drainage and fiber or fines retention because of diminished polymeric additive performance. To provide better insight for overcoming polymeric additive performance problems, this work investigated interactions between pulp furnish and dissolved and/or suspended materials accumulating in whitewater systems.

88. Single Procedure for Measuring Drainage, Retention, and Response to Vacuum of Pulp Slurries

Wegner, T. H.; Springer, A. M.; Chandrasekaran, S.
Tappi J. 67(4): 124-126; 1984.

No universally-agreed-upon, off-machine test adequately predicts the drainage behavior of pulp slurries on the paper machine. While procedures exist for measuring some aspects of drainage, retention, and vacuum response, no single procedure until now has given a combined measurement of these three process parameters. Here such a procedure is described.

89. Role of Web Properties in Water Removal By Wet Pressing: Influence of Basis Weight and Forming Method

Young, T. L.; Caulfield, D. F.; Wegner, T. H.
Tappi J. 66(10): 100-102; 1983.

More knowledge of the role that web properties play in dewatering in the wet press section is needed for developing ways to improve water removal. Hand-sheet and machine-formed webs of loblolly pine pulp were used to study the effects of basis weight and forming method on web dewatering. Dewatering behavior of webs over a range of basis weights was found to be analogous to the response of a Kelvin body to a compressive step input stress.

90. The Effects of Multiple Pressing on Web-Dewatering Behavior

Young, T. L.; Caulfield, D. F.; Wegner, T. H.
Tappi J. 67(4): 134-135; 1984.

The authors compare the dewatering behaviors of single- and multiple-pass pressed webs in terms of τ and C'. This information can be useful in optimizing wet press section design and performance because water removal in the wet press section can be achieved using many press configurations varying in number and length of press nips. Results show that increasing the effective nip residence time by increasing the number of nip passes results in dewatering equivalent to that achieved by increasing the residence time of a single-nip pass.

residues and energy

Wood Fuel Properties and Fuel Production from Woods

Baker, A. J.
In: Fuelwood Management and Utilization Seminar: Proceedings, East Lansing, MI; 1982 November 9-11. East Lansing, MI: Michigan State University; 1983. 152 p. (A limited number of copies of the complete book available from Publications Distribution, USDA Forest Service, Northeastern Area, State and Private Forestry, 370 Reed Road, Broomall, PA 19008. No charge.)

Energy Properties of Wood

Zerbe, J. I.
In: Fuelwood Management and Utilization Seminar: Proceedings, East Lansing, MI; 1982 November 9-11. East Lansing, MI: Michigan State University; 1983. 152 p. (A limited number of copies of the complete book available from Publications Distribution, USDA Forest Service, Northeastern Area, State and Private Forestry, 370 Reed Road, Broomall, PA 19008. No charge.)

wood materials

91. Effect of Chip Freezing On Quality of Ring-Cut Flakes

Carll, Charles G.; Wood, James E.
Forest Prod. J. 34(4): 35-36; 1984.

This study concerned ring flaking of frozen chips of three wood species from the northern United States. Frozen chips were expected to yield flakes with a higher proportion of fines than similar unfrozen chips. Study results confirmed this expectation.

The Variability of Lateral Fastener Resistance in New Wood-Base Structural Sheathing Products

Chow, Poo; McNatt, J. Dobbin
In: Proceedings of the Meeting of International Union of Forestry Research Organizations—Wood Engineering Group, June 28, 1983, Madison, WI. (Available from University of British Columbia, Department of Civil Engineering, 2324 Main Mall, Vancouver, BC, Canada V6T 1W5.)

Hardwood Structural Flakeboard for Industrial/Commercial Roof Decking: Successes and Problems to Solve

Hunt, M. O.; Hoover, W. L.; Harpole, G. B.
In: 1983 Proceedings of the Washington State University Particleboard Symposium, pp. 161-175. Complete book available from Washington State University, Wood Technology Section, Pullman, Washington 99164. (Paper available from Michael O. Hunt, Purdue University, Department of Forest Products, West Lafayette, IN 47907.)

92. Preheating Veneer Reduces Press Time in Phenolic-Bonded PLV

Jokerst, Ronald W.
Forest Prod. J. 34(2): 47-50; 1984.

The high cost of adhesive bonding has been a major obstacle to the production of parallel-laminated veneer (PLV) lumber in structural thickness. The objective of this study was to reduce the adhesive bonding costs and make the production of PLV lumber economically more attractive to potential producers.

93. Investigation of Various End Joints in Parallel-Laminated Veneer

Jung, Joseph
Forest Prod. J. 34(5): 51-55; 1984.

Douglas-fir parallel-laminated veneer (PLV) specimens with various end-joint types were tested in flatwise bending, edgewise bending, and tension. Results of these tests indicate that six-ply PLV members with 1/4-inch plies and 1 in 12 sloped scarf joints cut in either individual plies or multiple plies, and members with staggered butt-jointed interior plies and scarf-jointed exterior plies have generally comparable strengths with members with no joints.

94. Economic Feasibility of Synthetic Fiber Reinforced Laminated Veneer Lumber (LVL)

Laufenberg, T. L.; Rowlands, R. E.; Krueger, G. P.
Forest Prod. J. 34(4): 15-22; 1984.

The economic feasibility of manufacturing and marketing synthetically reinforced laminated veneer lumber (LVL) is presented. This paper is part of a broad study into the technical and economic potential for producing such materials.

95. Static Bending Properties of Structural Wood-Base Panels: Large-Panel Versus Small-Specimen Tests

McNatt, J. Dobbin
Forest Prod. J. 34(4): 50-54; 1984.

In this study, eight different structural panel products were tested in static bending using quarter-point loading of four different test panel sizes. The goal was to assess the effect of panel size on bending strength and variability of test values. Products tested included veneered composite panels, oriented strandboard, waferboards, and flakeboards.

96. How Some Test Variables Affect Bending, Tension, and Compression Values for Particle Panel Products

McNatt, J. D.; Superfesky, M. J.
USDA Forest Serv. Res. Pap. FPL 446, 1984.

Three different particle panel products—particleboard, waferboard, and alined flakeboard (lab-made)—were tested in bending, tension, and compression to evaluate the effects of various test conditions and specimen sizes on strength and stiffness. Standard ASTM-size bending specimens were loaded at midspan or at the quarter points.

97. Investigations on the Use of Spruce Bark in the Manufacture of Particleboard in Poland

Muszynski, Zenon; McNatt, J. Dobbin
Forest Prod. J. 34(1): 28-35; 1984.

Particleboard panels were made with bark contents between zero and 100 percent, in increments of 10 percent. Physical and mechanical test results indicated that boards suitable for furniture manufacture could be made with up to 30 percent bark content.

98. Research Progress in Wood-Based Composite Products

Youngquist, John A.
In: Baker, Andrew J., ed. Advances in Production of Forest Products. AIChE Symposium Series, No. 223; Vol. 79. 1981 November 8-12; New Orleans, LA. New York: American Institute of Chemical Engineers: 1983: 79-87.

The author makes a comparison between wood and other engineering materials. With this background, new developments in adhesive and molding technology in structural panel products and in glued structural members are discussed in detail.

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